properly recommends the consolidation of the land in large farms, and the liberal use of artificial manures.

The "normal manure" which M. Ville recommends is in its simplest form a mixture of superphosphate, saltpetre, and gypsum, thus supplying nitrogen, phosphoric acid, potash, and lime. Instead of employing the nitrate of potassium, a mixture of nitrate of sodium or sulphate of ammonium with chloride of potassium may be substituted; the manure then becomes a "normal homologous manure." This normal manure embraces all the chief elements of plant food which it may be necessary to apply to the land. It is unnecessary, however, to apply the entire mixture to every crop. Each crop demands a preponderance of one or other of the constituents of the manure; this "dominant" constituent is therefore increased when the manure is prepared for a particular crop; or the elements of the whole manure may be distributed through a rotation of crops, each crop receiving the part specially suited to it. Stated thus, we can only approve the recommendations which M. Ville has made; they are in fact, in their last-named form, precisely carried out by all our best farmers in the present day. Though, however, we have correctly stated the teaching which may be gathered from his book, there are many passages in the lectures which urge the return to the land of all the potash, phosphates, and lime which the crops have removed, a proceeding which is on many soils quite unnecessary, and therefore, very unremunerative.

M. Ville recommends that each farmer should set aside a small portion of his land to be treated with experimental manures. One plot of this ground would receive the normal manure; a second the same without nitrogen; a third the same without phosphates; a fourth the same without potash; while another plot would be left entirely without manure. By growing crops on these plots the farmer would learn in the most certain manner what elements of plant food were chiefly deficient in his soil in relation to the crops he wished to grow. This is excellent advice; no better could be given. It is only by such experiments that the true condition of the soil can be revealed; and it is only by thus testing the effect of manures before applying them on a large scale that an economic return can reasonably be expected. France is apparently ahead of us in the practical use of such experiments. Thanks to the centralisation which places the control of everything in the hands of the Government, field experiments of this description are now in progress in thirty-four farming schools throughout the country, while simpler experiments on the effects of manures have been established in connection with 350 day schools. In England we have but one place at which such experiments are thoroughly carried out, namely, Rothamsted.

Are we, then, to credit M. Ville with the discovery of the great effect to be obtained from artificial manures, or of the best mode of applying them? He claims for himself the honour of having discovered the principles he sets forth, and compares himself with Lavoisier, and his detractors with the detractors of that great man, and concludes:—"We must allow time to complete the work of justice, and give to every one his proper place." We will in reply simply mention a few dates. The famous field experiments at Rothamsted commenced in 1843; in the very first year trials were made of the effects of phosphates, potassium, magnesium, and ammonium salts. These field experiments have been carried on continuously up to the present time, and the effect of every variety of combination of manure has been shown in the fields devoted to wheat, barley, beans, clover, roots, pasture, and potatoes. That nitrogen should form the "dominant" constituent of a manure for wheat, and phosphates the dominant constituent of a manure for turnips, was clearly proved in the first two or three years of the experiments; and by 1849 the character of potash as the proper dominant in the case of beans and clover was also established. With these experiments M. Ville is well acquainted. Our last date shall be taken from his own book. The first field experiments made by M. Ville at Vincennes commenced in 1860.

The book contains several extraordinary statements. It would take too long to discuss M. Ville's views as to the assimilation of the free nitrogen of the air by all crops, but especially by the leguminosæ; immense quantities of nitrogen are, according to him, thus acquired. We are curious to know what authority he has for stating that when an animal is fed on hay one-third of the nitrogen is lost "in the act of digestion," and that another third is lost during the fermentation of the animal manure, so that only one-third of the original nitrogen is at last returned as manure to the land.

We cannot conclude without calling attention to the extremely untrustworthy character of the figures throughout the book. On p. 54 the mould on an acre of soil weighs 400,000 tons; on p. 180 it weighs 1,600 tons. On p. 353 the weight of resin yielded by an acre of pine trees is given as 4–5 cwts., but immediately after it is stated to be 1,122–1,540 lbs. The quantities of nitrogen to be applied are a complete puzzle. To take a single instance: On p. 238 we are told that to obtain a good crop of beet we must apply 70 lbs. of nitrogen per acre. On p. 357 the quantity has risen to 176 lbs. On pp. 367 and 368 the formulæ for the beet manures are given; each formula is stated to contain 187 lbs. of nitrogen; but on looking at the ingredients only 83 and 85 lbs. of nitrogen are found to be contained by the ammonium salts and nitrates employed. Finally, on p. 374 we are told that the nitrogen applied to beet should amount to 70–88 lbs. per acre. What are we to believe?

Both the old and new chemical notations are employed in the course of the book. R. W.

OUR BOOK SHELF

Lecture on the Gault. By F. G. H. Price. (Taylor and Francis, 1879.)

THIS pamphlet contains considerably more than a lecture, embodying a list of the French and English works upon the Gault, which have come under the author's notice, and nearly forty pages of tables of fossils.

The description of the gault at Folkestone has been amplified from that read by the author before the Geological Society.[1] He maintains his subdivision of the gault at Folkestone into beds, and endeavours to correlate with them, to some extent, the gault to the west. The outcrop at Eastbourne is separately described, and found to contain an unexpectedly long list of fossils. The Blackdown beds are included in the Gault, which is to be greatly regretted, for there is every reason to suppose that

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[1] *Quart. Journ. Geol. Soc.*, 1874, vol. xxx. p. 342.

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they are of much newer, and most probably upper greensand age: to tabulate their fauna with that of the gault, lessens the working value of the tables materially. The upper gault only is thought to be present in the Isle of Wight, where it is 100 feet thick. The little that is known of the gault in the Midland Counties is collected together, and that of Cambridgeshire and the red chalk at Hunstanton is briefly described. A few pages are devoted to the gault in France, a few lines to that of Switzerland, but no mention is made of any equivalents in Germany or in Belgium. The pamphlet contains in a compact form a deal of information upon the gault, which would have to be sought elsewhere in many publications, and it may prove of value to students at home and abroad.

The author believes that the bands which are characterised by fossils peculiar to them at Folkestone, can be traced elsewhere in England and in France. The range through the gault of most fossils is probably less restricted than is imagined, but some species are apparently strictly confined to narrow zones at Folkestone, although closely allied species abound in cretaceous rocks in England, and even America. It is likely that zones of fossils were due to the gradual alteration of depth which enabled certain gregarious forms to exist on the spot for a very short time only after their first migration to it. Their presence elsewhere would not prove that the zone was a continuous one; it would only indicate that at some period, not necessarily a synchronous one, the sea at that other spot had fulfilled the conditions of depth, &c., under which alone the particular species could exist. The same view applies to the idea that upper gault only was deposited in the Isle of Wight. There is no reason to suppose that deposition did not proceed there in the lower gault age, and it is more probable that the sea was, during the whole gault period, only fitted to receive that form of silt, and those fossils which are known at Folkestone as upper gault. The lower gault is spoken of by the author as a shallow sea deposit gradually deepening to the chalk, but the President of the Geological Society has stated his opinion that the gault is an extremely deep sea deposit, while Mr. Gwyn Jeffreys has collected much evidence to prove that the chalk was formed in shallow water. Whether we accept them or not, the views of such distinguished men should find a place in a work intended to be exhaustive.

Travels and Researches among the Lakes and Mountains of Eastern and Central Africa. From the Journals of the Late J. Frederic Elton, H.B.M. Consul at Mozambique. Edited and Completed by H. B. Cotterill. Maps and Illustrations. (London: Murray, 1879.)

ONE cannot read Consul Elton's Journals without feeling how great a loss his death has been not only to the cause of the native African, but to African exploration. Elton was only thirty-seven years of age when he succumbed to the hardships of African exploration, but he had already done more than his share of hard and useful work. The handsome and beautifully illustrated volume before us deals with his observations and adventures in Africa from 1873, when he went to Zanzibar as Vice-Consul to his death in December, 1877, when trying to push from the north end of Lake Nyassa to the coast at Dar-es-Salaam. Much of the earlier part of the volume tells of the work Elton did in putting down the slave-trade in the dominions of the Sultan of Zanzibar. In carrying out this work he had to visit most of the coast from Zanzibar to beyond Mozambique, as well as Madagascar, and with the details of his more immediate mission, is mixed up a good deal of geographical information. He carried on his works of benevolence and exploration on his appointment as Consul of Mozambique. The chief novelty of the volume, however, is in the second part, in which the story of the journey from the north end of Lake Nyassa north-east to the coast is told. Here Elton, Cotterill, and their companions broke on fresh ground, and made substantial additions to our knowledge of African geography and African people. With the main results of this journey we are already familiar, through the description of Mr. Cotterill at the Geographical Society and elsewhere. Elton left Mozambique in July, 1877, Livingstonia at the south end of Nyassa in September, and the north end on October 15. The country traversed was mainly hilly, rising in the Konde Mountains, north-west of Nyassa, to 12,000 feet. Elton speaks of the country as the "Garden of Africa." The party were delayed for a time in Merere's Country in the Konde Mountains, by one of those little wars, which so often embarrass African explorers, and during the delay some hardships had to be endured, which no doubt told on Elton's health. On December 19 he succumbed to what seemed sun-stroke, and was buried under the shade of a baobab in South Ushekke. Cotterill conducted the expedition to Bagamoyo, over what is comparatively well-known ground. In completing the narrative of the expedition and editing his late fellow-traveller's journals, in preference to publishing a narrative of his own, he has acted with an unselfishness which deserves to be acknowledged. The book is altogether one of much interest. The Rev. A. E. Eaton contributes a short Appendix on the Natural History of the Kungu Fly, out of which the natives to the north of Nyassa make cakes.

Conic Sections—The Method of Projections. By Rev. S. Bolton Kincaid, M.A. (London: Stanford, 1877.)

THIS book has only recently met our notice; it consists of a series of twenty-nine propositions deriving proofs of many of the chief properties of the ellipse by the method of circular projection. We have not come across any special novelty in the little book, nor have we detected many mistakes, though the lettering, from the use of like letters, we have found in many cases confusing. The figures face the text, and the circle figure is over the elliptical one; they are in many cases very roughly turned out by the engraver.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Comet 1879 *c* (Swift)

THE following observations may be useful to some of your readers:—On June 25 the comet was compared five times with the star O.A. 3268, with a ring micrometer (power 35); on June 28 it was compared eight times with the star Dm + 71°, 184 by means of a bar reticule with power 70. The comet has a bright spot near the centre which, on June 25, seemed to me to be nearly equal to a ninth magnitude star; but on June 28 it was much fainter, although easy to observe with precision after 11h. 30m. The diameter appears to be 2′ or 3′ in my telescope (of 4½ inches aperture) but I cannot see any trace of the tail mentioned by Mr. Swift. The comet is, however, immersed in the twilight now existing at midnight.

1879.	G.M.T. h. m. s.	Appt. R.A. h. m. s.	Appt. Dec. ° ′ ″
June 25	11 57 49	2 49 37·1	+ 68 41 37
June 28	11 30 20	2 51 13·3	+ 71 52 18

1, Vanbrugh Park, Blackheath

G. L. TUPMAN

The Mechanical Theory of Earth-Heat

IN reference to Mr. J. P. Lesley's inquiry as to whether plicated coal-beds are generally converted into anthracite, it has occurred to me that during a residence upon the Somersetshire coal district, thirty years ago, I recollect visiting the Vobster coal-pits, on the northern edge of the Mendip hills. The coal-seams are there exceedingly disturbed. One seam of coal was

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